



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/806,157

03/23/2004

Tetsuro Nakamura

03500.017976

2170

5514 7590 01/24/2008  
FITZPATRICK CELLA HARPER & SCINTO  
30 ROCKEFELLER PLAZA  
NEW YORK, NY 10112

EXAMINER

TRINH, THANH TRUC

ART UNIT

PAPER NUMBER

1795

MAIL DATE

DELIVERY MODE

01/24/2008

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/806,157	<b>Applicant(s)</b> NAKAMURA ET AL.	
	<b>Examiner</b> Thanh-Truc Trinh	<b>Art Unit</b> 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 29 October 2007.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,2 and 4-6 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2 and 4-6 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/ are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. Claims 1, 4-6 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites limitation "the zinc oxide layer" in lines 12, 13 and 16. There are two zinc oxide layers, it is unclear to which "zinc oxide layer" the claim is referring to.

Claims 4-6 also recite limitation "the zinc oxide layer" in line 2 or 3. There are two zinc oxide layers, it is unclear to which "zinc oxide layer" the claim is referring to.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

2. Claims 1-2 and 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shiozaki (US Patent 5977477) in view of Fujioka et al. (US Patent 5769963).

Regarding claim 1, Shiozaki discloses a method of producing a photovoltaic device comprising steps of forming a zinc oxide layer on a substrate at least by electrolytic deposition (See col. 4 lines 39-67); subjecting the zinc oxide layer to rare gas treatment (or ion irradiation) (See Abstract and col. 5 lines 1-12); and forming on the zinc oxide layer a semiconductor layer comprising a-Si, a non-single crystal silicon material, containing hydrogen and having at least one p-i-n junction. (See col. 5 lines 33-50). Shiozaki describes forming a zinc oxide layer by sputtering as described in Example 1, and further describes forming another zinc oxide layer by electroplating as described in Example 4. Therefore, Shiozaki teach forming a zinc oxide layer by sputtering before the forming the zinc oxide layer by electrodeposition.

Shiozaki does not teach providing an adsorption preventive layer between the zinc oxide layer and a p- or n-type semiconductor layer adjacent to the zinc oxide layer, wherein the adsorption preventive layer comprises a non-single crystal silicon material in which an amount of dopant is decreased compared to the p- or n-type semiconductor layer provided adjacent to the zinc oxide layer.

Fujioka et al. teaches providing an interface-adjacent region (108) between the conductive substrate (101) comprising ZnO (See col. 26 lines 33-45), wherein the

interface-adjacent region (108) comprises non-single crystal silicon material (or the same material that form the p- or n-type layer 102 – See col. 27 lines 25-38) in which an amount of dopant is lowered compared to the p- or n-type semiconductor layer (102). (See Figure 1; col. 8 line 46 to col. 9 line 5; col. 15 lines 24-34).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Shozaki by providing an adsorption preventive layer (or interface-adjacent region) between the zinc oxide layer and a p- or n-type semiconductor layer as taught by Fujioka et al., because Fujioka et al. teaches that providing an adsorption preventive layer (or interface-adjacent region) of decreasing amount of dopant on the side of one electrode would create a high-resistance region in the vicinity of the interface between the electrode and the semiconductor layer to thereby prevent excessive currents from flowing even when a short circuit locally occurs (See col. 6 lines 60-65), and the device would have a long-term reliability and would not suffer a great reduction of electrical characteristics. (See col. 3 lines 28-34)

Regarding claim 2, Shiozaki discloses the treatment is a rare gas plasma treatment using at least one rare gas selected from the group consisting of He, Ne, Ar. (See col. 5 lines 1-12)

Regarding claim 4, Shiozaki describes the thickness of zinc oxide layer is 1000 nm (See col. 10 lines 48-49), which is well within the claimed range of 10nm to 5 $\mu$ m.

Regarding claim 5, Shiozaki describes the zinc oxide layer having transmittance of 90% or more (See col. 4 lines 50-51). Therefore, it is inherent that the zinc oxide layer transmitting 50% or more of light with a wavelength of 800 nm.

3. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shiozaki (US Patent 5977477) in view of Fujioka et al. (US Patent 5769963) with evidence from Wronski (IEEE Transactions on Electronic Devices, Vol. ED-24, No. 4, April 1977).

Regarding claim 6, Shiozaki discloses a method of producing a photovoltaic device as described in claim 1, wherein the zinc oxide layer is adjacent to an n-type a-Si layer and has a conductivity of less than  $10^{-1} \times 1/\Omega\text{cm}$ , or a resistivity of  $10 \Omega\text{cm}$  or more. (See col. 4 lines 51-52). Note: resistivity =  $1/\text{conductivity}$ . Wronski teaches the n-type a-Si layer typically having a resistivity of about  $10^8 \Omega\text{cm}$  at substrate temperature of  $300^\circ\text{C}$  (See page 352, 1<sup>st</sup> paragraph of section titled "Discussion" of Wronski). It is the Examiner's position that Shiozaki teaches the zinc oxide layer having lower resistivity than that of the n-type semiconductor layer provided adjacent to the zinc oxide layer. Shiozaki teaches the limitation of the instant claim, therefore the reference is deemed to be anticipatory.

In addition, it is also the Examiner's position that a transparent conductive layer (zinc oxide layer) must have lower resistivity than that of a p- or n-type semiconductor layer adjacent to it in order for the transparent conductive layer (zinc oxide layer) to conduct electrons produced from the semiconductor layer, and complete the circuit.

### ***Response to Arguments***

Applicant's arguments with respect to claims 1-7 have been considered but are moot in view of the new ground(s) of rejection.

Applicant argues none of the references teaches "the adsorption preventive layer comprises a non-single crystal silicon material in which an amount of dopant is decreased compared to the p- or n-type semiconductor layer provided adjacent to the zinc oxide layer. The Examiner respectfully disagrees. As seen in the rejection above, Fujioka et al. teaches providing a adsorption preventive layer (or interface-adjacent region 108 as seen in Figure 1) comprises a non-single crystal silicon and has a lower amount of dopant compared to the semiconductor layer adjacent to the zinc oxide layer.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

Application/Control Number:  
10/806,157  
Art Unit: 1795

Page 7


the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh-Truc Trinh whose telephone number is 571-272-6594. The examiner can normally be reached on 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TT  
01/12/2008

  
NAM NGUYEN  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 1700